# Integrated Functional Appraisal (IFA)
# Nuclear Science Division

June 30, 2005


IFA Team Members

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*Carole Fried, Industrial Hygienist – EHS*
*Connie Grondona, RN – EHS*
*Kathie Hardy, ES&H Coordinator – NS*
*Matt Kotowski, Safety Engineer – EHS*
*Mark Lasartemay, Waste Management Coordinator – EHS*
*Betsy MacGowan, Industrial Hygienist – EHS*
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# Executive Summary

The Environment, Health, and Safety (EHS) Division of Lawrence Berkeley National Laboratory (LBNL) conducted an integrated functional appraisal (IFA) of Nuclear Science (NS) Division during April—June 2005. The scope of the IFA was to review 1) a comprehensive sampling of technical work conducted under formal and facility-based authorizations (such as increased-hazard work requiring an activity hazard document [AHD], radiological work authorization [RWA], or facility safety analysis document [FSAD]); 2) a representational sampling of technical work conducted under line management authorization (such as routine laboratory and shop work); and 3) a representational sampling of office work.

IFA team members were selected based on their expertise in the following fields: industrial hygiene, industrial safety, ergonomics, radiation protection, fire safety, electrical safety, and waste management. The team held several meetings, which included an opening meeting, laboratory space inspections, office space inspections, and a close-out meeting.

The results of the IFA indicate that overall, NS Division has a strong environment, safety, and health (ES&H) program that is generally effective in identifying and controlling hazards. The IFA team identified several noteworthy practices. The division has improved in its workstation ergonomics, radiation safety, and LCATS use. As expected, most findings centered around Building 88, where the team inspected the most space. Increased vigilance is warranted in the areas of OSHA compliance, seismic safety, and especially electrical safety. With the prompt correction of specific Building 88 electrical safety issues, the IFA team concludes that NS Division is operating safely and within its authorized limits.

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# 1 Introduction

The Environment, Health, and Safety (EHS) Division of Lawrence Berkeley National Laboratory (LBNL) conducted an integrated functional appraisal (IFA) of Nuclear Science (NS) Division during April—June 2005. The IFA is a key component of LBNL's integrated safety management (ISM) system and forms one of the three tiers (along with management of environment, safety, and health [MESH] reviews and self-assessments) of the Lab's safety assessment program. EHS Division conducts an IFA for each laboratory division every three years. NS Division's last IFA was performed in 2002.

## 1.1 IFA Purpose

The purpose of the 2005 IFA of NS Division was to conduct an environment, safety, and health (ES&H) technical review of the division's work activities and operations.

## 1.2 Scope

The scope of the IFA was to review

- Technical work conducted under formal and facility-based authorizations (such as increased-hazard work requiring an activity hazard document [AHD], radiological work authorization [RWA], or facility safety analysis document [FSAD]) (a comprehensive review)
- Technical work conducted under line management authorization (such as routine laboratory and shop work) (a representational sampling)
- Office work (a representational sampling)

# 2 Appraisal Process

## 2.1 Team

### 2.1.1 *Selection*

Team members were selected based on their expertise in the following fields: industrial hygiene, industrial safety, ergonomics, radiation protection, fire safety, electrical safety, and waste management. As experts in these fields, team members have knowledge of and experience in identifying the primary hazards posed by NS Division work.

- Electrical safety: Robert Candelario
- Environmental protection: Linnea Wahl
- Ergonomics: Jeffrey Chung
- Fire protection: Gary Piermattei
- Industrial hygiene: Carole Fried and Betsy MacGowan
- Occupational health: Connie Grondona and Cathy Wentworth
- Occupational safety: Ross Fisher and Matt Kotowski
- Radiation protection: Jeff Bramble
- Waste management: Mark Lasartemay

### **2.1.2** *Member Roles and Responsibilities*

All team members were responsible for reporting any ES&H concern they identified, regardless of their field of expertise. Subject matter experts were asked to review the applicable databases and NS Division authorizations with respect to their field of expertise. The team leader had the additional responsibilities of coordinating meetings, communicating results to NS Division staff, and preparing reports.

### **2.1.3** *Meetings*

The team held several meetings, which included an opening meeting, laboratory space inspections, office space inspections, and a close-out meeting. Meetings were held on the following schedule.

- April 18, 2005: Opening meeting and inspection of lab spaces in Building 70 attended by Jeff Bramble, Bob Candelario, Connie Grondona, Kathie Hardy, Matt Kotowski, Neil Landau, Mark Lasartemay, Betsy MacGowan, Gary Piermattei, Barry Savnik, and Linnea Wahl.
- April 25, 2005: Inspection of shop and lab spaces in Building 88 attended by Jeff Bramble, Bob Candelario, Carole Fried, Connie Grondona, Kathie Hardy, Matt Kotowski, Mark Lasartemay, Betsy MacGowan, Gary Piermattei, Barry Savnik, and Linnea Wahl.
- April 29, 2005: Inspection of lab spaces in Buildings 50, 50A, and 51 attended by Jeff Bramble, Bob Candelario, Ross

Fisher, Carole Fried, Kathie Hardy, Betsy MacGowan, Gary Piermattei, Linnea Wahl, and Cathy Wentworth.

- May 17, 2005: Inspection of office spaces in Building 88 attended by Jeffrey Chung, Connie Grondona, and Linnea Wahl.
- May 24, 2005: Inspection of office spaces in Building 50B attended by Jeffrey Chung, Connie Grondona, and Linnea Wahl.
- June 1, 2005: Inspection of office spaces in Building 70 attended by Jeffrey Chung, Barry Savnik, and Linnea Wahl.
- June 27, 2005: Close-out meeting attended by Jeff Bramble, Ross Fisher, Carole Fried, Kathie Hardy, Matt Kotowski, Kevin Lesko, Betsy MacGowan, Gary Piermattei, Barry Savnik, James Symons, and Linnea Wahl.

## 2.2 Defining Appraisal Areas

### 2.2.1 *Document and Database Reviews*

Team members received copies of NS Division AHDs and the Building 88 FSAD. In addition, appropriate subject matter experts reviewed other formal authorizations and databases:

- Jeff Bramble reviewed radiation-related authorizations (RWAs, radiological work permits [RWPs], sealed source authorizations [SSAs], low-activity source authorizations [LASs], and x-ray authorizations).
- Carole Fried reviewed confined space permits.
- Betsy MacGowan reviewed respiratory protection user certifications.
- Mark Lasartemay reviewed a list of waste management areas: radioactive waste collection areas (RWCAs), satellite accumulation areas (SAAs), and mixed waste satellite accumulation areas (MWSAAs).
- Connie Grondona reviewed the ergonomics database.
- Linnea Wahl reviewed the following databases: hazards, equipment, authorizations, and reviews (HEAR); supervisor's accident analysis report (SAAR); LBNL corrective action tracking system (LCATS); and training. She also reviewed results from past inspections (MESH

reviews, IFAs, self-assessments, and Occupational Safety and Health Authorization [OSHA] inspections).

**2.2.2** *Identification of Facility-Level Operations*

NS Division has only one facility-level authorization, *88-Inch Cyclotron Safety Analysis Document*. There are no environmental permits or authorizations specific to NS Division; however, sitewide permits and regulations apply to solvent wipe cleaning at Building 88 and sewer discharges and air emissions from all buildings occupied by NS Division personnel.

**2.2.3** *Identification of Medium- and High-Hazard Spaces and Operations*

The team leader, Linnea Wahl, and the NS Division ES&H Coordinator, Kathie Hardy, met to identify spaces where formal work authorizations are in effect. Such spaces are in Buildings 88 and 70.

**2.2.4** *Identification of Higher Potential Line Management Authorized Work -Technical Work Spaces*

The chair of the NS Division ES&H Committee, Kevin Lesko, requested review of the IceCube project space. The IceCube Project operates under line management authorization in Buildings 50, 50A, and 51. The project is representative of NS Division work conducted under line management authorization. Appendix B lists additional NS Division work that is authorized by line management.

**2.2.5** *Identification of Representative Nontechnical Work Space*

Linnea Wahl and Kathie Hardy determined that office spaces in Buildings 50B, 70, and 88 would provide a representative sample of nontechnical work spaces.

**2.2.6** *Scheduling of Space Reviews/Inspections*

Kathie Hardy scheduled inspections of lab and shop space in Buildings 70 and 88 to meet researchers' schedules and to coincide with the division's self-assessment inspections. Kathie scheduled the inspections of space in Buildings 50, 50A, and 51 (the IceCube project) as the researchers were available.

Linnea Wahl scheduled initial inspections and interviews with one researcher in his or her office in each of Buildings 50B, 70, and 88. Additional offices in the vicinity were inspected and interviews conducted on an *ad hoc* basis.

### 2.3 Space Reviews

At the scheduled time, the IFA team met with the NS Division personnel who work in the space under review. The group introduced themselves, and NS Division personnel gave a brief summary of their work. The IFA team inspected the space for hazards, paying particular attention to issues identified in previous reviews. Whenever possible, issues were resolved on the spot. IFA team members noted all issues identified, whether resolved or not, on inspection sheets. The team leader later compiled the results submitted on inspection sheets and sent the results for review to the team and NS Division staff.

### 2.4 Interviews

During each inspection, IFA team members asked questions of the NS Division staff who worked in the space. Answers were used to help focus the inspection.

## 3 Findings

### 3.1 Facility Authorizations

#### 3.1.1 *Safety Analysis Documents*

The IFA team had no findings with respect to NS Division's single FSAD, *88-Inch Cyclotron Safety Analysis Document* (October 1996). The IFA team leader observed that the FSAD is quite dated. The IFA team recommends that the document be reviewed and, if necessary, updated to reflect current operating conditions and regulatory requirements.

#### 3.1.2 *Other Permits (BAAQMD, EPA, EBMUD)*

The IFA team had one finding with respect to NS Division's compliance with environmental permits and regulations. In Building 70, sinks in two labs lacked the proper signs prohibiting the disposal of hazardous substances. See Appendix D for details of this finding.

#### 3.1.3 *Status of the Authorization*

NS Division's single FSAD, *88-Inch Cyclotron Safety Analysis Document,* was prepared in January 1995 and revised in October 1996. The regulatory basis of the document was Department of Energy (DOE) Order 5480.25, Safety of Accelerator Facilities,

which has been superseded by DOE Order O420.2B (July 23, 2004). DOE Order O420.2B is listed in the Laboratory's work smart standards set.

## 3.2 Formal Work Authorizations

NS Division has two ES&H committees, one that is facility-wide and another that is specific to operations at the 88-inch Cyclotron. These committees meet quarterly to review many of the division's formal authorizations. Formal authorizations for NS Division work are listed in Appendix A, List of Facility and Formal Authorizations.

### 3.2.1 *Status of Renewals*

*AHDs.* The NS Division ES&H Coordinator, Kathie Hardy, coordinates the renewal of AHDs annually. A new document, AHD 2096, was approved in May 2005. All other AHDs were last renewed in May/June 2004 and are currently in the renewal process.

*RWAs and other radiation-related authorizations*. The Operational Health Physics Group reviews and updates radiation-related authorizations every 12 or 18 months, depending on the hazard of the activities authorized. All radiation-related authorizations are current. NS Division currently has no RWPs or x-ray authorizations.

*Other authorizations*. Waste area listings, confined space permits, and respiratory protection user certifications are all current.

### 3.2.2 *Current Personnel*

Authorized workers are listed on both AHDs and radiation-related authorizations. Personnel from NS Division update lists of authorized worker when AHDs are renewed or revised. Personnel from the Operational Health Physics Group update lists of authorized workers when radiation-related authorizations are renewed or revised. The principal investigator's signature on these documents certifies that only the listed personnel are authorized to work on the project.

### 3.2.3 *Training*

Training is addressed during the NS Division self-assessment. Classroom training requirements associated with formal work authorizations are identified through the job hazard questionnaire (JHQ). On-the-job training (OJT) requirements are listed in RWAs, SSAs, and some AHDs.

The team leader identified a noteworthy practice in the approach to OJT taken by the principal investigator of AHD 2068, Daniela Leitner, who maintains OJT checklists for authorized workers. The checklists are conveniently kept in a binder near the project area, where training takes place. The IFA team recommends that all AHDs use this approach, where appropriate.

### **3.2.4** *Authorization Content Reflects Current Conditions and Requirements*

See Section 3.2.1 for discussion of how formal authorizations are maintained.

### **3.2.5** *Technical ES&H Issues Review*

As discussed in Section 1.2, the IFA team performed a comprehensive review of NS Division laboratories where work is performed under formal authorization. The team classified their results as

- findings, or failures to comply with a regulatory requirement;
- observations, or opportunities for process improvement; and
- noteworthy practices.

The IFA team results are provided in Appendix D, Technical Environment, Safety, and Health Inspection Results.

During the IFA team's technical ES&H issues review of Building 88, unresolved electrical safety issues in the area behind the control room were a major concern. Following the IFA closeout meeting, NS Division corrected these findings to the satisfaction of the IFA team.

### **3.2.6** *Validation of Hazard Identification Database (HEAR or Equivalent)*

The Operational Health Physics Group maintains radiation-related authorizations in the RADAR database. The database is current.

The NS Division ES&H Coordinator, Kathie Hardy, keeps original AHDs, and the EHS Division AHD coordinator, Larry McLouth, files AHD copies. Both files are current.

The HEAR database is used for some, but not all, NS Division formal authorizations.

### 3.2.7 *Work Smart Standards Envelope*

The IFA team did not specifically review Berkeley Lab's work smart standards for their applicability to new or existing NS Division work.

## 3.3 Line Management ('Self-Authorization') Space/Operations

Operations requiring line management authorization are common throughout NS Division space. For such operations, the two division ES&H committees meet quarterly to review division work projects.

As discussed in Section 1.2, the IFA team performed a representative review of NS Division work conducted under line management authorization. The IFA team reviewed the IceCube Project, which operates in Buildings 50, 50A, and 51. The team classified their results as

- findings, or failures to comply with a regulatory requirement;
- observations, or opportunities for process improvement; and
- noteworthy practices.

The IFA team results are provided in Appendix D, Technical Environment, Safety, and Health Inspection Results.

### 3.3.1 *Is Line Management Authorized Work Properly Identified*

The IceCube Project is a 1-$km^3$ international high-energy neutrino observatory being built and installed in the clear deep ice below the South Pole Station. The work done at Berkeley Lab includes the design and testing of the data acquisition system, the sensor that is deployed in the ice, the overall software system architecture, and the software for experiment control. The group also analyzes data transmitted daily from the South Pole to North America.

Project staff have completed hazard assessment forms (the project/facility safety review questionnaire, which is equivalent to the HEAR database form) to identify the project's hazards. The reviews indicate that the processes and hazards control are routine and conform to the NS Division ISM plan. Thus, in accordance with PUB3000, line management authorization is appropriate for the IceCube Project.

### 3.3.2 *Validation of Hazard Identification Database (HEAR or Equivalent)*

The NS Division project leader keeps original hazard assessment forms (project/facility safety review questionnaire), and the ES&H Coordinator, Kathie Hardy, files copies.

The HEAR database has entries for some NS Division work conducted under line management authorizations but the entries are not complete or current. The IFA team recommends that the HEAR database be used to document projects, perhaps by room number, for which project/facility safety review questionnaires are completed.

## 3.4 Nontechnical Space/Operations

As discussed in Section 1.2, the IFA team performed a representative review of NS Division work conducted in office spaces. The team reviewed the following locations. They represent about 55% of Building 50B, 28% of Building 70, and 15% of Building 88 NS Division offices.

**Table 1. NS Division Office Spaces Reviewed by IFA Team**

| Building 50B | Building 70 | Building 88 |
|---|---|---|
| 5203 | 227 | 219 |
| 5205 | 228 | 221 |
| 5209 | 229 | 223 |
| 5212 | 231 | 229 |
| 5215 | 234 | 230 |
| 5216 | 236 | 234 |
| | 241 | 235 |
| | 242 | 236 |
| | 308 | |
| | 319A | |

The team classified their results as

- findings, or failures to comply with a regulatory requirement;
- observations, or opportunities for process improvement; and
- noteworthy practices.

The IFA team results are provided in Appendix D, Technical Environment, Safety, and Health Inspection Results.

## 3.5 Database and Past Audit Review

### 3.5.1 *LCATS Database*

The 2004 MESH review of NS Division raised the concern that the division's use of LCATS has been inconsistent in the past. In 2004 and 2005, eight items were entered in LCATS. Seven items have been closed out. The one remaining has a target end date of July 12, 2005. At a minimum, the IFA team recommends tracking the findings of this IFA in LCATS.

### 3.5.2 *CMS Database*

As part of NS Division's self-assessment for 2005, the division will review its use of the CMS database to manage chemical inventory. Over the past two months, division update of the database has increased from 39% to 72%, which indicates an impressive effort.

### 3.5.3 *SAAR Database*

In the past year, all reported injuries (three) have been related to ergonomics. In the previous two years, only one ergonomic injury was reported. Ergonomic injuries appear to be on the rise. NS Division is aware of the issue and has taken steps to address it:

- In the 2004 MESH review, the division committed to training 25% of employees in ergonomics.
- As of June 2005, 85% of employees for whom ergonomic training is recommended or required by their JHQ have completed the training.
- As of June 2005, 52% of employees for whom ergonomic evaluation is recommended or required by their JHQ have received the evaluation.

### 3.5.4 *RWA Violations*

The 2004 MESH review suggested that NS Division take steps to decrease the number of RWA violations. The division has done just that, having had no major violations since June 2004.

### 3.5.5 *OSHA Inspection Results*

As of June 2005, NS Division has completed corrective actions on all 37 issues identified during the 2004 OSHA inspection. Closure

has been documented for 21 issues; the remainder are expected to be documented by June 30, 2005.

### 3.6 General Compliance Summary

As expected, most findings centered around Building 88, where the team inspected the most space. Overall, seismic hazards and electrical safety issues were the most common findings. The team also noted many findings related to OSHA compliance. Inspection findings are summarized in Appendix C, Compliance Matrix of Operations Reviewed.

## 4 Recommendations

Based on the IFA team's technical ES&H issues reviews, recommendations are listed as actions to be taken in Appendix D. In addition, based on document, database, and audit reviews, the IFA team recommends that NS Division take the following actions.

- The *88-Inch Cyclotron Safety Analysis Document* should be reviewed and, if necessary, updated to reflect current operating conditions and regulatory requirements.
- For the appropriate AHDs, principal investigators should document completion of OJT using checklists maintained in a binder.
- The HEAR database should be used to document projects, perhaps by room number, for which project/facility safety review questionnaires are completed.
- The findings of this IFA should be tracked in LCATS.
- Building 88 managers should consider instituting periodic electrical inspections by the building's electrical staff. Electrical problems identified during these self-audits should be resolved as quickly as possible.

## 5 Noteworthy Practices

The IFA team identified several noteworthy practices, which are listed in Appendix D. In particular, the IFA team commends NS Division for

- good use of project/facility safety review questionnaires and electrical hazard risk analyses for the IceCube Project.
- investing in ergonomic furniture and accessories for most offices.
- excellent housekeeping in Building 70 labs and Building 88 shop, east alley niches, Cave 1, and Cave 4A.

- conscientious seismic hazard abatement in Building 51 work space.
- excellent use of OJT checklists for staff authorized to work under AHD 2068.
- up-to-date emergency response guides posted prominently in Building 88.

# 6 Conclusion

Overall, NS Division has a strong ES&H program that is generally effective in identifying and controlling hazards. ES&H has the support of NS Division management, two effective ES&H committees, and an active ES&H coordinator.

The IFA team identified several noteworthy practices. The division has improved in its workstation ergonomics, radiation safety, and LCATS use. Increased vigilance is warranted in the areas of seismic and electrical safety and OSHA compliance. In particular, the team identified continuing electrical safety issues at Building 88. With the prompt correction of these electrical safety issues, the IFA team concludes that NS Division is operating safely and within its authorized limits.

# Appendices

Appendix A List of Facility and Formal Authorizations

Appendix B List of Line Management Authorized Operations

Appendix C Compliance Matrix of Operations Reviewed

Appendix D Technical Environment, Safety, and Health Inspection Results

Appendix E Photographs

Appendix E Photographs

# Appendix A List of Facility and Formal Authorizations

Facility Safety Analysis Document (FSAD)

- 88-Inch Cyclotron Safety Analysis Document

Radiological Work Authorizations (RWAs) and Low-Activity Source Authorizations (LASs)

- RWA 1017, B70 Heavy Element Nuclear and Radiochemistry Group
- RWA 1052, 88-Inch Cyclotron Heavy Element Radiochemistry Group
- RWA 1054, Building 88 Waste Characterization
- RWA 1079, LBNL Low Background Counting Facility
- RWA 1080, Berkeley Experiment with Accelerated Radioactive Species (BEARS) Project
- RWA 1103, Weak Interactions Group
- RWA 1104, Target Preparation
- RWA 1115, Investigation of Bacterial-Actinide Interactions
- RWA 1147, Prompt Gamma Activation Analysis
- RWA 5027, Cyclotron Proper Vacuum Envelope Maintenance (Deflector and RF Tank Work)
- RWA 5083, 88-Inch Cyclotron Operation and Maintenance
- L013, Irradiating Electronic Components
- L018, Electroplating Molybdenum Ribbon

Sealed Source Authorizations (SSAs)

- SSA 181, Sources for testing CMOS detectors
- SSA 183, Sources for calibrating 88-Inch Cyclotron detectors
- SSA 208, Source for calibrating proportional detector

Activity Hazard Documents (AHDs)

- AHD 128, Advanced Electron Cyclotron Resonance (AECR) Ion Source
- AHD 152, Electron Cyclotron Resonance (ECR) Ion Source
- AHD GS1036, Prompt External Radiation Fields
- AHD GS1040, Radioactive Atom Laser Trapping

- AHD GS1041, $^{14}O$ Production
- AHD GS1057, Berkeley Gas Separator (BGS)
- AHD GS1063, Berkeley Experiments with Accelerated Radioactive Species (BEARS)
- AHD 2036, PRISM Laser
- AHD 2066, RETRAP Laser
- AHD 2068, VENUS Ion Source
- AHD 2096, GRETINA Detector

Radioactive Waste Collection Areas (RWCAs)

- 70A-203 (3 areas)
- 70A-209 (3 areas)
- 88-135
- 88-Cave 0

Satellite Accumulation Areas (SAAs)

- 70A-203
- 70A-209
- 88-135
- 88-Cave 5
- 88 Machine shop
- 88 Basement

Mixed Waste Satellite Accumulation Areas (MWSAAs)

- 70A-203
- 70A-209 (2 areas)

Confined Space Permits

- RF tank in vault
- Axial hole on vault roof

Respiratory Protection User Certification

- Brien Ninemire, NS Division

# Appendix B List of Line Management Authorized Operations

As stated in PUB3000, operations are considered authorized under the division's self-authorization if "the process and hazards control are routine and conform to the individual division's ISM plan and the individuals are trained as specified [by the JHQ] . . ." The following list includes all courses taken by NS Division employees as required by the JHQ, and thus encompasses all operations authorized by NS Division line management.

| Course ID | Course Title |
|---|---|
| EHS0010 | Introduction to ES&H at LBNL |
| EHS0060 | Ergonomics for Computer Users |
| EHS0116 | First Aid Safety |
| EHS0154 | Emergency Team Training |
| EHS0231 | Compressed Gas and Cryogen Safety |
| EHS0256 | LockOut/TagOut Verification |
| EHS0260 | Basic Electrical Hazards and Mitigations |
| EHS0274 | Confined Space Retraining |
| EHS0275 | Confined Space Hazards |
| EHS0280 | Laser Safety |
| EHS0281 | Laser Safety Retraining |
| EHS0285 | Noise Hazard Training |
| EHS0288 | Laser Eye Exam |
| EHS0289 | Laser Safety Awareness |
| EHS0310 | Respirator Training |
| EHS0318 | Respirator Supervisor Training |
| EHS0329 | Lead Hazard Communication |
| EHS0330 | Lead Hazards Awareness |
| EHS0342 | Beryllium Hazard Communication |
| EHS0348 | Chemical Hygiene and Safety |

| Course ID | Course Title |
|---|---|
| EHS0405 | General Employee RadiationTraining |
| EHS0440 | RadProt-Accelerator-RadAuthReq |
| EHS0530 | Fire Extinguisher Safety |
| EHS0531 | Fire Extinguisher Safety Refresher |
| EHS0535 | Hot Work Permit Training |
| EHS0604 | Hazardous Waste Generator |
| EHS0610 | Waste Accumulation Areas |
| EHS0622 | Radioactive/Mixed Waste Generator |
| NSD1002 | Vault Radiation Survey Procedure |
| NSD1003 | Experimental Area Survey Procedure |
| NSD1004 | Vault Search & Secure Procedure |
| NSD1005 | Pit Search & Secure Procedure |
| NSD1006 | Trench Search and Secure Procedure |
| NSD1007 | Caves Search and Secure Procedure |
| NSD1016 | Vault Roof Search and Secure Procedure |
| NSD1018 | Oxygen Deficiency Hazard Survey |
| NSD1019 | Slammer Valve Operating Procedure |
| NSD1020 | Operators Aids Posting Procedure |
| NSD1021 | Shift Change-Over Procedure |
| NSD1022 | Cyclotron RF Resonance Tank Entry |
| NSD1023 | Deflector Block Moving Procedure |
| NSD2165 | Flammable Gas And Procedure Training |
| NSD3002 | 88" Cyclotron Shift Experiment |
| NSD3003 | Experimenter Machine Shop Safety |

# Appendix C Compliance Matrix of Operations Reviewed

| Type of Finding | Number of Findings | | | | | | |
|---|---|---|---|---|---|---|---|
| | Bldg 50 | Bldg 50A | Bldg 50B | Bldg 51 | Bldg 70 | Bldg 88 | Total |
| Asbestos/Lead Hazard | | | | | | 6 | 6 |
| Chemical Management | | | | 2 | 3 | 4 | 9 |
| Electrical Safety | 1 | 1 | | 2 | 1 | 12 | 17 |
| Environmental Safety | | | | | 2 | 3 | 5 |
| Fire Safety | 1 | 1 | | | 1 | 7 | 10 |
| Housekeeping | | | | | | 2 | 2 |
| OSHA Compliance | | | | | 3 | 9 | 12 |
| Pressure System | | | | | 3 | 5 | 8 |
| Radiation Safety | | | | | 3 | 1 | 4 |
| Seismic Hazard | 1 | 2 | 3 | 1 | 7 | 16 | 30 |
| Training | | | | 1 | | | 1 |
| Trip/Fall Hazard | | | | | 6 | 3 | 9 |
| Waste Management | | | | | | 3 | 3 |

# Appendix D Technical Environment, Safety, and Health Inspection Results

## Findings

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 50 | 6003 | Book case is not seismically braced. | Contact Facilities Work Request Center to have seismic bracing installed. |
| 50 | 6003 | Electrical junction box at floor level has opening in cover plate. Proper cover plate or blank must be installed | Ross Fisher contacted Facilities Work Request Center to have blank installed. |
| 50 | 6003 | Wooden wedge is used to prop door open. | Remove door wedge. |
| 50A | 6105 | One nut is missing on seismic bracing stud at base of environmental chamber. | Contact Facilities Work Request Center to have seismic bracing completed. |
| 50A | 6105 | Seismic bracing of basket shelving along south wall is installed with cable ties. The Facilities structural engineer does not consider plastic cable ties adequate for seismic protection. | Contact Facilities Work Request Center to review and correct seismic bracing. |
| 50A | 6105 | Cover plate missing from outlet box (no receptacle) on north wall under middle window; ground wire is visible in box. | Ross Fisher contacted Facilities Work Request Center to have cover plate installed. |
| 50A | 6105 | There is less than 28 inches clear for passage next to the Logic Analyzer stand. | Move stand to obtain clearance. |
| 50B | 5205 | Books on bookshelves are not seismically secured. | Provide seismic restraints (chains, bungee cords) for items on bookshelves. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 50B | 5205 | Heavy boxes stored overhead on top of bookshelf are not seismically secured. | Store boxes on floor or add seismic restraints. |
| 50B | 5209 | Books on bookshelves are not seismically secured. | Provide seismic restraints (chains, bungee cords) for items on bookshelves. |
| 51 | 14 | A standard U-ground duplex outlet at about the midline of the north wall (between workbench island and cabinets) is labeled “Dead” with a Post-It note. | Ross Fisher contacted Facilities Work Request Center to have the outlet either repaired or properly decommissioned. |
| 51 | 14 (outside in hall) | Small flammable liquids safety cabinet is not braced and is not provided with an electrical ground connection. The spring inside the door is not connected. | Contact Facilities Work Request Center to brace and ground cabinet and connect door spring for flammable liquids safety cabinet. |
| 51 | 14 | Miller-Stephenson Quik-freeze MS-242N containing 1,1,1,2-tetrafluoroethane 811-97-2 is not in Chemical Management System. | Add to Chemical Management System. |
| 51 | 14 | Kester flux pen #951 is not included in Chemical Management System. | Add to Chemical Management System. |
| 51 | 14 | Researcher uses lead/tin solder but has not taken course in lead hazard communication. | Complete the online course EHS0329, Lead Hazard Communication. |
| 51 | 14 | Electrical panel 61A13A enclosure front is secured by one screw. (Note: This panel is outside of Room 14 and is under the purview of building owner.) | Ross Fisher contacted Facilities Work Request Center to have the cover properly secured. |
| 70 | 203 | A benchtop centrifuge was lacking in interlocked lid (OSHA requirement) | Replace centrifuge with one that has an interlocked lid. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 70 | 203 | He gas system was lacking a pressure relief device | Install a pressure relief device immediately downstream of the regulator, set at a pressure no higher than the maximum allowable working pressure of the lowest rated component in the system. |
| 70 | 203 | An O2/He gas system was lacking a pressure relief device. | Install a pressure relief device immediately downstream of the regulator, set at a pressure no higher than the maximum allowable working pressure of the lowest rated component in the system. |
| 70 | 203 | Corrosives and flammables cabinets not secured or seismically braced and not electrically grounded. | Contact the Facilities Structural Engineering Section (Fred Angliss) to provide seismic anchoring and electrical grounding for the corrosives and flammables cabinets. |
| 70 | 203 | Door to office area from laboratory does not latch securely. | Adjust door so it latches. |
| 70 | 203 | No date or information on radioactive material label under north hood. | Fill out label. |
| 70 | 203 | Fixed contamination area FC-009 last surveyed 1/14/04. | Contact radiological control technician (RCT) (John Van Wart) to complete annual survey. |
| 70 | 203 | Calcium gluconate in hydrofluoric acid emergency response kit expired. | Replace calcium gluconate. |
| 70 | 203 | Small sink on raised ledge not labeled to prevent disposal of hazardous substances. | Post sink with sign provided by EHS liaison. |
| 70 | 209 | A benchtop centrifuge was lacking in interlocked lid (OSHA requirement) | Replace centrifuge with one that has an interlocked lid. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 70 | 209 | An N2 gas system was lacking a pressure relief device | Install a pressure relief device immediately downstream of the regulator, set at a pressure no higher than the maximum allowable working pressure of the lowest rated component in the system. |
| 70 | 209 | Flammable liquid safety cabinets not seismically braced or electrically grounded. | Contact the Facilities Structural Engineering Section (Fred Angliss) to provide seismic anchoring and electrical grounding for flammables cabinets. |
| 70 | 209 | Door to office area from laboratory does not latch securely. | Adjust door so it latches. |
| 70 | 209 | Container 252185, a 50-cc vial of beige powder, is not labeled. | Label side of vial. |
| 70 | 209 | Calcium gluconate in hydrofluoric acid emergency response kit expired. | Replace calcium gluconate. |
| 70 | 209 | Small sinks on raised ledge not labeled to prevent disposal of hazardous substances. | Post sinks with signs provided by EHS liaison. |
| 70 | 210 | The two lead shielding arrangements that are painted blue lack seismic anchoring | Contact the Facilities Structural Engineering Section (Fred Angliss) to have seismic anchoring designed and installed. |
| 70 | 210 | The grounding and bonding for the cable tray system is questionable | Have the electricians check out the grounding/bonding for the cable tray system and upgrade as needed. |
| 70 | 210 | Flammable liquid safety cabinets not seismically braced or electrically grounded. | Contact the Facilities Structural Engineering Section (Fred Angliss) to provide seismic anchoring and electrical grounding for flammables cabinets. |
| 70 | 210 | Three chairs have unsafe leg configuration (four rather than five casters). | Discard unsafe chairs. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 70 | 227 | Wooden bookcase near door is not seismically secured. | Contact Facilities Work Request Center (x6274) to have seismic bracing installed. |
| 70 | 229 | Corner of rug in the walkway is turned up and presents a trip hazard. | Fasten corner securely with Velcro or rotate rug so turned up corner is under sofa. |
| 70 | 229 | Books on bookshelves are not seismically secured. | Provide seismic restraints (chains, bungee cords) for items on bookshelves. |
| 70 | 228 | Chairs in lounge have unsafe leg configuration (four rather than five casters). | Discard unsafe chairs. |
| 70 | 228 | Carpet in front of sliding glass door is torn and presents a trip hazard. | Repair or replace carpet. |
| 70 | 228 | Equipment cords extend across the walkways and present trip hazard. | Roll up cords and store out of the way or run them through a cord cover. |
| 70 | 231 | Chair has unsafe leg configuration (four rather than five casters). | Discard unsafe chair. |
| 70 | 234 | Fluorescent bulbs in ceiling fixtures in food preparation area are not enclosed. | Contact Facilities Work Request Center (x6274) to have covers or sleeves installed over fluorescent bulbs. |
| 70 | 241 | Books on bookshelves are not seismically secured. | Provide seismic restraints (chains, bungee cords) for items on bookshelves. |
| 88 | Throughout | Doors are wedged open. | Remove wedges so doors stayed shut. |
| 88 | 130 | Near metal cabinet, egress path is less than 24-in. Fire Code minimum. | Move metal cabinet. |
| 88 | 130 (Hall outside) | Storage in the hallway in unsecured near the emergency exit from the building. | Remove the storage cabinets or write a Facilities Work Request to provide seismic anchoring for the storage cabinets. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 88 | 131 (Hall outside) | Fluorescent light cover is not securely attached. | Contact Facilities to secure light fixture. |
| 88 | 134 | Bottles with no labels in tray on north side of room. | Label bottles. |
| 88 | 134 | Lead brick used as door stop. | Do not use lead as a door stop. Store appropriately. |
| 88 | 134 | Cable tray lacks proper grounding. | Write a Facilities work request to ground the cable tray to meet LBNL standards. |
| 88 | 134 | Sink is not posted with warning advising against disposal of hazardous substances. | Contact Environmental Services Group (Ginny Lackner) to obtain sticker and post at sink. |
| 88 | 135 | Chemicals stored in cabinet next to computer work station required seismic restraints since the door is left open. | Install lips on the shelves or place chemicals in secondary containment trays. |
| 88 | 135 | Cardboard box was on the counter filled with chemicals wrapped in plastic bags. One chemical was leaking. (Norman was the name on the chemicals) | Store chemicals in appropriate containers. Clean up the leaking chemical. |
| 88 | 135 | Calcium gluconate gel in spill response kit expired in 7/2002. | Replace calcium gluconate gel. |
| 88 | 135 | Pressure vessel (apparently an old LPG tank) has been impermissibly modified. | Discard the vessel. |
| 88 | 135 (Hall outside) | Cabinet and drawing file drawers are not braced in corridor and pose hazard in seismic event. | Brace cabinet and restrain drawers. |
| 88 | 135 (Hall outside) | Combustibles are stored in corridor. | Remove combustible storage from corridor. |
| 88 | 135 (Hall outside) | Emergency eyewash/shower ES-134-88 has multiple inspection tags. | Remove Haws-supplied tags. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 88 | 137 | No LBNL tag on lifting fixture. | Contact Facilities riggers to obtain certification. |
| 88 | 137 | Cable tray system lacks proper grounding and bonding. | Write a Facilities work request to upgrade the grounding and bonding on the cable tray system to meet LBNL standards. |
| 88 | 137 | Two 208V disconnect switches are obstructed by flammables cabinet. | Provide a clear area 30 inches wide and 36 inches deep in front of the disconnect switches. |
| 88 | 147 (Shop) | No hazard label on waste container. | Label added; resolved on the spot. |
| 88 | 147 (Shop) | Metal in rear storage room requires seismic restraint. | Restrain metal. |
| 88 | 147 (Shop) | Nitric acid metal storage container (100 lb) is stored behind the door in the rear storage room; container is dented where door hits it. | Relocate to a more appropriate storage location. |
| 88 | 147 (Shop) | Exit sign above door is too small. | G. Piermattei will provide replacement sign meeting code. |
| 88 | 147 (Shop) | In NW corner, plug strip is mounted to building I-beam. | Remove plug strip. |
| 88 | 147 (Shop) | Screws for main power panel cover are missing. | Replace missing screws. |
| 88 | 147 (Shop) | Shield on local extraction arm is cracked. | Replace shield. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 88 | 147 (Shop) | Width to the exit access from the work benches near the window is not adequate. | Move the work benches closer to the window so that there is a minimum aisle width of 28 inches from the benches to the door. Also, do not store movable carts in a manner that will reduce the exit access to less than 28 inches. |
| 88 | 147 (Shop) | Nuts on the Baldor Grinder diamond sharpening wheels are exposed. | Provide guards that cover the nuts on the diamond sharpening wheels as discussed with the machinist. |
| 88 | 147 (Shop) | Nuts and flanges on the Cincinnati buffer are exposed. | Modify the guards to enclose the nuts and flanges on the buffer wheels, as discussed with the machinist. |
| 88 | 155 | Numerous file cabinets are not seismically secured. | Provide seismic anchoring for the file cabinets. |
| 88 | Behind Control Room | Numerous terminals are exposed at rear of many instrument racks. Note that this was pointed out during the pre-OSHA inspection of 2003 and that no corrections have been made since then. | Block off access to the rear of instrument racks with exposed terminals immediately, and work with the Electrical Safety Engineer to upgrade the insulation and enclosure to meet LBNL standards. |
| 88 | Behind Control Room | Numerous light bulbs and some empty sockets in the instrument racks; many unguarded “test lamps” (light bulbs). | Install required shielding for all bare light bulbs. |
| 88 | East Alley Niches | Sealed Source HC-5022 was checked out to Cave 4A on 8/29/02, but there are no sources in Cave 4A. | Update sealed source log book. |
| 88 | East Alley | Only face shield and gloves used when transferring pressurized liquid nitrogen (LN). | Goggles are required in addition to face shield and gloves. |
| 88 | East Alley Mezzanine | Two instrument racks, PMT060 (6 ft tall) and S17 (4 ft tall) not seismically secured. | Provide seismic tie-downs for the instrument racks. In this case, chaining to structural steel may be the most appropriate solution. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 88 | Cave 0 | Waste minimization issue in SAA. | Resolved on the spot. |
| 88 | Cave 0 | No label on SAA. | Label added; resolved on the spot. |
| 88 | Cave 0 | Suspect asbestos pipe insulation at ceiling above cryocenter has exposed ends. | Contact Industrial Hygiene (Rob Connolly) for assistance in checking for asbestos and abating or repairing 12-inch section. |
| 88 | Cave 0 | Access to panel PNL-101-88 was obstructed. | Provide a clear area 30 inches wide and 36 inches deep in front of the electrical panel. |
| 88 | Cave 1 | Damaged/peeling lead based paint on the wall at the cave entrance at the seismic joint. | Remove the damaged peeling paint. |
| 88 | Cave 1 | Exit access to two work stations is only 22 inches wide instead of the required 28 inches. | Abandon use of the work stations in this cave. This would eliminate the need for maintaining the aisle width for an exit access, and the existing 22 inches suffice for machinery service access. |
| 88 | Cave 2 | Fire Extinguisher sign still posted after there is no longer a fire extinguisher at this location. (Extinguisher nearby satisfies code requirements.) | Sign was removed; resolved on the spot. |
| 88 | Cave 4C (outside) | 6-ft-tall bookcase is unsecured. | Provide seismic anchoring for the bookcase. |
| 88 | Cave 5 | Access to disconnect switch “Rack T18 Disconnect” is obstructed. | Provide a clear area 30 inches wide and 36 inches deep in front of the disconnect switch. |
| 88 | Cave 5 | 7-ft-tall storage cabinet and Rack Y03 are unsecured. | Provide seismic anchoring for the storage cabinet and Rack Y03. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 88 | Cave 5 | Access to panel PNL-125-88 is not adequate, and access to disconnect AC-008-88 is obstructed. | Provide a clear area 30 inches wide and 36 inches deep in front of the disconnect switch and in front of the panel. |
| 88 | Cave 5 | Copper coils with large diameter wires are exposed near the east wall. | Check the available voltage and current levels on the exposed coils and provide insulation or shielding as needed. |
| 88 | High Bay | Suspect asbestos pipe insulation has exposed ends on hot water system at entrance to second hallway. | Contact Industrial Hygiene (Rob Connolly) for assistance in checking for asbestos and abating or repairing 12-inch section. |
| 88 | High Bay | Chain across crane ladder not secured. | Secure chain across ladder. |
| 88 | 161A | Access to panel PNL-070-88 was obstructed. | Provide a clear area 30 inches wide and 36 inches deep in front of the electrical panel. |
| 88 | 161B (outside Radiation Effects Testing Facility) | Access to panel 518A was obstructed | Provide a clear area 30 inches wide and 36 inches deep in front of the panel. |
| 88 | 161B-adjacent | Housekeeping needs improvement. Old electronics, cables, etc. are stored throughout the area. | Clean the area. |
| 88 | Vault roof | Lead apron laying on floor is cracked and damaged. | Cover exposed lead with tape to prevent airborne lead dust. |
| 88 | Vault roof (SW area) | Panel PNL-030-88 is obstructed. | Provide a clear area 30 inches wide and 36 inches deep in front of the panel. |
| 88 | Vault roof (SW area) | Numerous file cabinets and storage cabinets are not seismically anchored. | Provide seismic anchoring for the file cabinets and storage cabinets. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 88 | Vault roof (SW area) | Uneven floor area constitutes a tripping hazard. | Provide additional plywood floor panels to reduce the tripping hazards in this area. |
| 88 | Vault roof (North side) | Numerous storage cabinets are not seismically anchored, only bolted to each other. | Provide seismic anchoring for the storage cabinets. |
| 88 | Vault roof (Northeast side) | Access to the service platform for several panels including PNL-129-99 was obstructed. | Provide clear access to the service platform in front of panel PNL-129-88. |
| 88 | Cave Roof-(VENUS Project) | Inappropriate storage of gas cylinders under PNL-012-88. Some cylinders have regulators attached and others have caps. | Establish which cylinders are in use and which are in storage. If in storage, caps are required & regulators must be removed. Cylinders must be secured. |
| 88 | Cave Roof (AECR area) | Housekeeping behind the AECR needs improvement. | Clean the area. |
| 88 | Cave Roof (Outside BGS shack) | Chairs have unsafe leg configuration (four rather than five casters). | Discard unsafe chairs. |
| 88 | Cave Roof (Outside BGS shack) | Access to an elevated platform was provided using a modified ladder stand instead of a fixed ladder or a stair case. The ladder stand lacks the required weight rating for stairs, and the top step is much higher than other steps, creating multiple OSHA violations. | Replace the ladder stand with a fixed ladder or with a Lapeyre stair (http://www.lapeyrestair.com/). |
| 88 | Cave Roof | Inappropriate storage of gas lecture bottles. Some bottles have regulators attached and others have caps. | Establish which cylinders are in use and which are in storage. If in storage, caps are required & regulators must be removed. Cylinders must be secured. |

| Building | Room | Finding[a] | Action |
|---|---|---|---|
| 88 | Cave 4C Roof | Heavily oxidized lead bricks are stored on roof. | Survey and dispose of bricks if not needed (comply with DOE moratorium) or have them cleaned and appropriately stored. |
| 88 | Cave 4C Roof | Liquid nitrogen shut off to cave 4C is blocked. | Ensure that the path is unobstructed once LN system is re-installed in Cave 4C for GRETINA Experiment. |
| 88 | 221 | Bookshelves are not seismically secured. | Provide seismic anchoring for the bookshelves. |
| 88 | 229 | Bookshelves are not seismically secured. | Provide seismic anchoring for the bookshelves. |
| 88 | 230 | Books on bookshelves are not seismically secured. | Provide seismic restraints (chains, bungee cords) for items on bookshelves. |
| 88 | 230 | File cabinets are not seismically secured. | Provide seismic anchoring for the file cabinets. |
| 88 | 230 | Chairs have unsafe leg configuration (four rather than five casters). | Discard unsafe chairs. |
| 88 | 235 (passageway) | Books on bookshelves are not seismically secured. | Provide seismic restraints (chains, bungee cords) for items on bookshelves. |
| 88 | 236 | Books on bookshelves are not seismically secured. | Provide seismic restraints (chains, bungee cords) for items on bookshelves. |

[a] A finding is a failure to comply with a regulatory requirement

## Observations

| Building | Room | Observation[a] | Action |
|---|---|---|---|
| 50 | 6003A | Ceiling access for Facilities equipment is located above research equipment in secure area, but maintenance technicians may not be aware of access procedures. | Post detailed access instructions on door to alert technicians. Include researchers' phone numbers so Facilities personnel can contact them. Enter equipment in HEAR database; contact ES&H coordinator (Kathie Hardy) for assistance. |
| 50A | 6105 | Ceiling access for Facilities AHU 1-50A and PB G Belt 2436 is located above research equipment in secure area, but maintenance technicians may not be aware of access procedures. | Post detailed access instructions on door to alert technicians. Include researchers' phone numbers so Facilities personnel can contact them. Enter equipment in HEAR database; contact ES&H coordinator (Kathie Hardy) for assistance. |
| 50A | 6105 | Door is kept locked to protect equipment by preventing entry by unauthorized personnel, although it can be opened by a master key. | Contact the Lock Shop if more restrictive access control is desired. |
| 50B | 5205 | Spilled liquid under coffee pot could cause an electrical hazard. | Clean up tray under coffee pot and line with absorbent paper. |
| 50B | 5205 | Computer screen is too close to eyes. | Consider obtaining computer glasses from Health Services (x4435) and purchasing a flat-screen monitor. |
| 50B | 5205 | Arms on chair are not adjustable. | Consider obtaining new ergonomically correct chair through the Chair Loaner Program (visit the Display Center in Bldg 26-126). |
| 50B | 5215 | At work station to left of door, researcher works exclusively on small laptop computer. | Consider purchasing external mouse to prevent strain from constant trackpad use. |
| 50B | 5215 | At work station to right of door, researcher works exclusively on laptop computer with trackpad and roller bar. | Consider purchasing stand for laptop to raise the screen to eye level and purchasing separate keyboard with soft-touch keys. |

| Building | Room | Observation[a] | Action |
|---|---|---|---|
| 50B | 5215 | At work station in front of door, center drawer in wooden desk prevents researcher from raising chair to proper height. | Remove center drawer. |
| 50B | 5216 | Wrist rest is worn and torn. | Replace wrist rest, which provides cushioned support for forearms. |
| 50B | 5216 | At work station nearest door, monitors are at different heights, which could cause neck strain. | Consider placing both screens at same height, with top of screen at eye level. |
| 51 | 14 | Old-style plug mold plug strips are stored in the room. | Discard plug strips in salvage hopper. |
| 51 | 14 | UL listing on interlock device is questionable. | Bob Candelario will investigate and respond to researchers. |
| 51 | 14 | Administrative controls are used for protection against power supply voltage. | Although the level of power exposure is < 500 watts, consider the use of physical safeguards whenever possible. |
| 51 | 14 | As with most lab spaces there is a tendency to accumulate material and equipment over time. This lab has an abundance of equipment for the space allocated. This can lead to several issues:<br>- Stacking of materials leading to seismic hazard potential. This was not actually too bad in the lab, but the potential must be considered.<br>- The storage of combustible materials (cardboard boxes, etc.) adds up over time.<br>- Electrical outlets and cords become covered and difficult to trace.<br>- Electrical power cords as well as telephone and/or data cables can become strained; i.e., stressed at the point of attachment. This can become serious when there is no strain relief in place.<br>- Movement of an item might unwittingly stress another power or communication cable. | Use the lab's relocation in the near future as an opportunity to<br>- Weed out some of the decommissioned and other extraneous equipment and stored materials,<br>- Review the loads on each of the relocatable power taps.<br>- Ensure that adequate electrical outlet access is permanently wired into the new location. |

| Building | Room | Observation[a] | Action |
|---|---|---|---|
| | | - There is an abundant use of relocatable power taps. They do all appear to be used for light electronic and data management equipment which is appropriate. | |
| 51 | 14 | Loudspeaker box sitting on top of HVAC ducting is not secured and could fall during an earthquake. | Secure loudspeaker box. |
| 70 | 203 | Chemical labeled 1,10 Phenanthroline OR not bar coded. | Add to Chemical Management System. |
| 70 | 203 | Radioactive material area (RMA) boundary tape on floor is worn on east side of room. | Contact RCT (John Van Wart) to replace worn tape around RMA. |
| 70 | 203 | Poorly designed stepstool can slide unexpectedly. | Discard stepstool. |
| 70 | 209 | Eyewash has multiple inspection tags with conflicting information | Contact Facilities (John Hutchings or Mike Botello) to consolidate into a single inspection tag. |
| 70 | 209 | RMA boundary tape on floor is worn. | Contact RCT (John Van Wart) to replace worn tape around RMA. |
| 70 | 229 | Laptop keyboard presents a hard surface for resting wrists and forearms. | Consider purchasing palm pads to rest wrists on. |
| 70 | 227 | Chairs do not have armrests or back support. | Obtain new ergonomically correct chairs through the Chair Loaner Program (visit the Display Center in Bldg 26-126). |
| 70 | 227 | Kneeholes in desks are not high enough. | Call Facilities Work Request Center (x6274) to have center drawer and supporting bar removed. |
| 70 | 227 | Documents are not close enough to screen. | Consider purchasing a slant board to hold documents while typing. |
| 70 | 241 | Laptop used at home is not in an ergonomically correct situation. | Consider purchasing stand for laptop to raise the screen to eye level and purchasing separate keyboard. |

| Building | Room | Observation[a] | Action |
|---|---|---|---|
| 70 | 241 | Documents are not close enough to screen. | Consider purchasing a clip-on document holder to raise documents to screen level. |
| 70 | 241 | Room has poor air circulation. | Consider purchasing a fan to keep air moving during warm weather. |
| 70 | 308 | Researcher requested an ergonomic evaluation. | Jeffrey Chung performed the evaluation on-the-spot. |
| 70 | 319 | Chair arms are not well padded. | Consider purchasing gel-type covers to cushion arm rests. |
| 88 | Throughout | 60% of chemical inventory locations have been updated since July 1, 2004. | Update at least 85% of locations or owners in Chemical Management System before June 30, 2005. |
| 88 | 134 | Silicone rubber compound in cabinet at back wall does not have barcode label. | Add barcode. |
| 88 | 135 | Nitrile gloves in spill response kit are old and may have deteriorated. | Check gloves for leaks and replace if necessary. |
| 88 | 147 (Shop) | Poor housekeeping on floor around second bench from NW corner. | Clean up floor. |
| 88 | Cave 0 | Sign on door does not include contact information. | Add contact information to sign. |
| 88 | Cave 5 | "High/low" thermometer on the wall above the Friedrich control contains mercury. | If thermometer is not in use, contact Larry McLouth for assistance with disposal. If still in use, consider replacing it with an alcohol thermometer. |
| 88 | Cave 5 | Floor grating posted "Keep Clear" is obstructed from above by laser table. | If grating is not an egress, remove sign. If it is an egress, relocate laser table. |
| 88 | 161B-adjacent (Dance Floor) | Empty cardboard box is labeled "Toxic Material Do Not Touch--L. Lin." | Remove warning sign when box is not in use. |

| Building | Room | Observation[a] | Action |
|---|---|---|---|
| 88 | Vault Roof (RAMA Project) | Housekeeping in radioactive material area needs improvement. | Clear excess equipment off floor. |
| 88 | Vault Roof (Cerny Area) | Bolts used to seismically secure roof shielding stick up and present tripping hazard. | Until Facilities can complete on-going project to countersink bolts, mark the hazard with orange cones. |
| 88 | ECR Suite | Access to panel PNL-006-88 is questionable. | Have the panel checked out for adequate working clearances by Tom Caronna, Electrical Safety Engineer. If needed, relocate panel. |
| 88 | 221 | Office is cluttered with piles of papers which could make it difficult to get out in an emergency. | Clean up office. |
| 88 | 221 | Computer/keyboard arrangement is not adjustable. | Consider purchasing a flat screen display monitor, installing an adjustable keyboard tray, obtaining computer glasses from Medical Services. |
| 88 | 230 | Computer/keyboard arrangement and chair are not adjustable. | Request an ergonomic evaluation to determine best arrangement for specific user. |
| 88 | 232 | At work station nearest door, monitor is too close to eyes and adjustable keyboard tray is not being used. | Request an ergonomic evaluation to determine best arrangement for specific user. |

[a] An observation is an opportunity for process improvement.

**Noteworthy Practices**

| Building | Room | Noteworthy Practice |
|---|---|---|
| 50 | 6003A | Project/Facility Safety Review Questionnaire in place showing that hazards have been assessed and controlled. |
| 50 | 6003A | Authorized personnel list, hazard/warning signs, and rules for safe entry are prominently displayed outside DOM test cabinet. |
| 50 | 6003A | All staff authorized to work in software lab have read and signed procedure for working in test cabinet. |
| 50A | 6105 | Project/Facility Safety Review Questionnaire in place showing that hazards have been assessed and controlled. |
| 50A | 6105 | A copy of PUB3000, Chapter 8, Electrical Safety, is posted and used as a reference. |
| 50B | 5203 | Office has adjustable chairs and flat screen monitors. |
| 50B | 5209 | Office has adjustable chair, keyboard tray, and flat-screen monitor. |
| 50B | 5212 | Office has adjustable chair and three different computer systems so user's work position varies throughout the day. |
| 51 | 14 | The research group has prepared and submitted an electrical hazard risk analysis to the NS Division ES&H Committee |
| 51 | 14 | This lab has done a thorough job of seismic anchoring of its benches, cabinets, shelves, and large equipment. Even a step ladder was closed, wedged behind a column and tied to the column |
| 70 | All | The rooms evidenced exceptionally good housekeeping |

| Building | Room | Noteworthy Practice |
|---|---|---|
| 70 | All | RWA compliance reviews have consistently found that "the researchers have done an excellent job maintaining their radioisotope journal" (RWA 1017). No RWA compliance violations have been cited. |
| 70 | All | Waste storage areas (RWCAs, SAAs, and MWSAAs) are consistently kept neat and in compliance. |
| 70 | 229 | Office has adjustable chairs and flat screen monitor, which is used to display laptop screen. |
| 70 | 236 | Office has adjustable chair and keyboard tray. |
| 70 | 241 | Desk has good leg space and researcher displayed good awareness of ergonomics issues. |
| 88 | Throughout | Emergency Response Guides are posted, up-to-date, and filled out. |
| 88 | 134 | Two unsafe chairs with 4 wheels were noted in this room during an AHD review a short time prior to this inspection. The chairs have been removed. |
| 88 | 147 (Shop) | Excellent housekeeping throughout shop, and especially in tool storage area. |
| 88 | 147 (Shop) | All sinks are labeled to warn against disposal of hazardous substances. |
| 88 | East Alley Niches | Excellent housekeeping. |
| 88 | Cave 1 | Excellent housekeeping in the cave. |
| 88 | Cave 4A | Excellent housekeeping in the cave. |
| 88 | Cave Roof (near RETRAP Laser) | Laser eyewear is clearly labeled and readily available. |

| Building | Room | Noteworthy Practice |
|---|---|---|
| 88 | Cave Roof (near VENUS Project area) | OJT records for staff authorized to work under AHD 2068, VENUS Project, are documented by the principal investigator and kept in a binder near the project control area. |
| 88 | 219 | Office has adjustable chair and adjustable keyboard tray. |
| 88 | 223 | Office has adjustable chair and desk height is appropriate for keyboard. |
| 88 | 229 (south workstation) | Workstation has vertical mouse, which computer user finds comfortable. User displayed good awareness of ergonomic issues. |
| 88 | 234 | Computer user has adjustable chair and displayed good awareness of ergonomic issues, especially need to take frequent breaks from computer use. |
| 88 | 235 (south cubicle) | Workstation has flat panel monitor, adjustable keyboard tray, adjustable chair, and good task lighting. User displayed good awareness of ergonomic issues. |
| 88 | 235 (north cubicle) | Workstation has adjustable keyboard tray and adjustable chair. |

# Appendix E Photographs

Fig. 1. Building 88, Cave1: Damaged/peeling lead based paint on the wall at the cave entrance at the seismic joint.

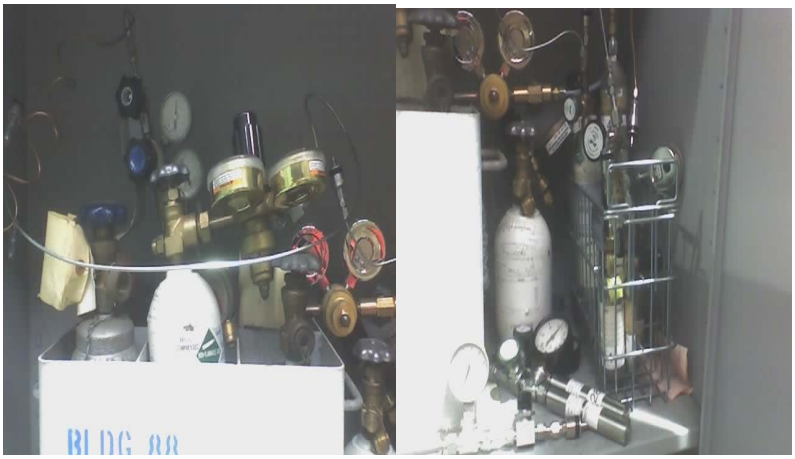

Fig 2. Building 88, Cave Roof (VENUS area): Inappropriate storage of gas cylinders under PNL-012-88. Some cylinders have regulators attached and others have caps.


Fig. 3. Building 88, Cave Roof: Inappropriate storage of gas lecture bottles. Some bottles have regulators attached and others have caps.

# Appendix F List of Acronyms

| | |
|---|---|
| AECR | Advanced electron cyclotron resonance |
| AHD | Activity hazard document |
| BEARS | Berkeley Experiment with Accelerated Radioactive Species |
| BGS | Berkeley gas separator |
| CMS | Chemical Management System |
| DOE | Department of Energy |
| ECR | Electron cyclotron resonance |
| ES&H | Environment, safety, and health |
| FSAD | Facility safety assessment document |
| HEAR | Hazards, equipment, authorizations, and reviews |
| IFA | Integrated functional appraisal |
| ISM | Integrated safety management |
| JHQ | Job hazards questionnaire |
| LAS | Low-activity source |
| LBNL | Lawrence Berkeley National Laboratory |
| LCATS | LBNL Corrective Action Tracking System |
| LN | Liquid nitrogen |
| LPG | Liquefied petroleum gas |
| MESH | Management of ES&H |
| MWSAA | Mixed waste satellite accumulation area |
| NS | Nuclear Science |
| OJT | On-the-job training |
| OSHA | Occupational Safety and Health Administration |
| RCT | Radiological control technician |
| RF | Radiofrequency |
| RMA | Radioactive material area |
| RWA | Radiological work authorization |
| RWCA | Radioactive waste collection area |
| RWP | Radiological work permit |
| SAAR | Supervisor’s accident analysis report |
| SAA | Satellite accumulation area |
| SSA | Sealed source authorization |